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Life Expectancy at Birth from the Avar Period to the Árpádian Age: Pagan-Christian Change in Hungary

József Turtóczki[1], László Szathmáry[2]

[1]Magyar Gyula Horticultural Technical and Vocational School, Budapest, Hungary
[2]Department of Evolutionary Zoology and Human Biology,University of Debrecen, Debrecen, Hungary

ABSTRACT

This paper analyzes the data on life expectancy at birth from significant archaeological sites in Hungary related to the Avar, Hungarian Conquest, and Árpádian periods. The cluster analysis based on life expectancy at birth data successfully distinguishes the populations of the Avar and Hungarian Conquest periods from the Árpádian populations. It is likely that local factors play a significant role in the observed life expectancy at birth. The analysis results in patterns of population development similar to those described in previous studies. Accordingly, Püspökladány serves as an example of continuous population growth, while Ibrány demonstrates interrupted development. The cluster analysis also reveals a more distant relationship between the two periods of the Ibrány site compared to Püspökladány. The merged d0-14 percentages of mortality data significantly differ between the two distinct clusters in the cluster analysis, supporting the notion that the difference in life expectancy at birth can be attributed to the changing proportions of child burials. It is assumed that the adoption of Christianity led to changes in burial customs, resulting in a higher proportion of child burials in cemeteries.

Key words: *demographic anthropology, paleo-demography, life expectancy at birth, Avar age, Árpádian age*

Introduction

In Hungary, the transition from the Avar period through the Hungarian Conquest to the Árpádian age was accompanied by significant social changes. One of the most essential and defining moments was the adoption of Christianity, which brought about structural transformation in society, as well. The change in burial practices from the 11th century, including grave goods, is an indication of this period of transformation[1]. Previous studies have examined the demographic changes of these specific periods from various perspectives, but a number of questions regarding population history during these periods have remained unanswered. This paper tries to find answers to a few of these questions from a paleodemographic standpoint.

In a previous study, the populations of the Hungarian conquest and the Árpádian age were compared. These examinations revealed significant differences in life expectancy at birth between the two periods. The current study represents a rethought and expanded version of that paper[2].

For the present analysis, primarily data from the Hungarian sites with relatively large sample sizes were examined. The demographic comparison and evaluation of the Avar, Hungarian conquest, and the Árpádian age populations were based on life expectancy at birth data from these sites. No comprehensive demographic investigation of these specific periods using the methods chosen has been conducted so far.

Material and Methods

Life expectancy at birth provides one of the most characteristic features of the demographic profile of a cemetery population. For the examinations, estimated life expectancy at birth was used, which was based on individual mortality ages determined from skeletal remains of Avar, Hungarian conquest, and Árpádian age sites (Table 1). Cemeteries with statistically large sample size were selected for the database. In total, the data of 3602 individuals were included in the analysis. Particular attention was paid to sites that had representatives from both the 10th and 11th centuries. These sites were

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TABLE 1

THE CHRONOLOGICAL DISTRIBUTION OF THE EXAMINED POPULATIONS AND THE ESTIMATED LIFE EXPECTANCY AT BIRTH

No	Site	N	Century	e_x^0 (years)
1	Hajdúnánás[9]	18	7-9	32.16
2	Pitvaros-Víztározó[10]	218	7-9	32.44
3	Nyírgyháza-Oros, Nyulaska[11]	51	7-9	36.60
4	Keszthely-Fenékpuszta[12]	102	7-9	42.21
5	Kaposvár Road 61 Site No. 26[13]	254	7-9	27.61
6	Kereki-Homokbánya[14]	153	7-9	32.67
7	Hajdúszoboszló-Árkoshalom[15]	132	10	35.56
8	Ibrány-Esbóhalom[16]	142	10	33.06
9	Karos-Eperjesszög II-III[17]	39	10	35.99
10	Kál[18]	68	10	34.90
11	Püspökladány-Eperjesvölgy[15]	231	10	27.18
12	Sárbogárd[19]	100	10	32.10
13	Szegvár-Oromdűlő[20]	93	10	29.52
14	Tengelic[21]	33	10	34.20
15	Tiszafüred[22]	113	10	32.15
16	Hajdúszoboszló-Árkoshalom[15]	109	11	24.23
17	Ibrány-Esbóhalom[16]	130	11	36.48
18	Püspökladány-Eperjesvölgy[15]	371	11	28.26
19	Sárszentágota[23]	19	11	30.42
20	Szegvár-Oromdűlő[20]	259	11	29.08
21	Tiszalúc-Sarkadpuszta (unpublished)	225	11	19.71
22	Magyarhomorog-Kónya-domb[24]	524	11–12	29.80
23	Jászberény-Szent Pál-halom[25]	218	11–13	30.73

N – The case numbers; ex0 – estimated life expectancy at birth

Püspökladány-Eperjesvölgy[3], Hajdúszoboszló-Árkoshalom[4], Ibrány-Esbóhalom[5] and Szegvár-Oromdűlő[6]. The majority of the anthropological data of the selected cemeteries have been published. Both in the present paper and in the studies referred to, the estimation of mortality age was based on morphological criteria using methods widely accepted in specialized literature[7,8].

For the demographic analysis, the life expectancy at birth (e_x^0) of the populations in each cemetery was estimated on the basis of the available individual mortality ages, if this parameter was not already available in published literature. To digitize and analyze the data, a paleoanthropological software package developed by Bernert[26] was applied. In this case, the sexes could not be treated separately because sex determination for subadult individuals is uncertain. Therefore, in further analysis, the life expectancy at birth for both sexes was considered together.

Regarding the calculation of life expectancy at birth, there was a lack of uniformity among the authors in using the Coale-Demény method's neonatal correction[27], which posed methodological challenges for the present examinations.

The data obtained were subjected to hierarchical cluster analysis to reveal the relationships between the different sites. The results were analyzed and evaluated using a cluster tree. The cluster analysis was performed using SPSS v. 26 software.

Results and Discussion

Based on the estimated life expectancy at birth for the sites, the cluster analysis of the sites resulted in two distinct and separate clusters, as observed in Figure 1.

One of the clusters mainly consists of the cemeteries from the 7th to 10th centuries, while the other cluster primarily includes cemeteries from the 11th to 13th centuries. Within the 7th to 10th century cluster, Ibrány's 11th-century site stands out against the rest, while within the 11th to 13th century cluster, Püspökladány's and Szegvár's 10th-century representatives deviate from the chronological norm. However, the latter two were continuously used cemeteries with representatives from both periods. This draws attention to the significance of local factors affecting population when it comes to life expectancy at birth. Hajdúszoboszló's population is an exception as the data from the two periods (10th and 11th centuries) are classified into separate clusters. From the Avar period (7th to 9th centuries), only Kaposvár Road 61 Site No. 26 is included in the 11th to 13th century cluster as a unique exception. The average life expectancy at birth (e_x^0) of the two distinct clusters is 33.22 for the 7th to 10th century and 28.59 for the 11th to 13th century, showing a significant difference (t-test, p=0.019).

Although life expectancy at birth is not suitable for the genetic evaluation of these populations, the present cluster analysis reveals patterns already observed in previous studies. These include the continuous and disrupted population development trends seen in cemetery populations. The continuous development of Püspökladány's population is supported by craniometric data (Püspökladány-type development[28]). On the other hand, the disrupted population development is exemplified by Ibrány's 10th and 11th century cemetery (Ibrány-type development[29–35]). In the dendogram we can observe a closer connection between the 10th century populations and the 11th century populations from Püspökladány than between the corresponding populations in Ibrány. Hajdúszoboszló stands out most prominently, indicating disrupted development, which is also supported by anthropological findings[33].

In the next step, the demographic data within the two distinct clusters identified on the dendrogram were examined. It is assumed that the difference in the average life expectancy at birth is primarily due to varying proportions of child burials between the two groups. The mortality data (dx) for the Infants I and Infants II age groups (d_{0-14}) were merged, which indicated the percentage of

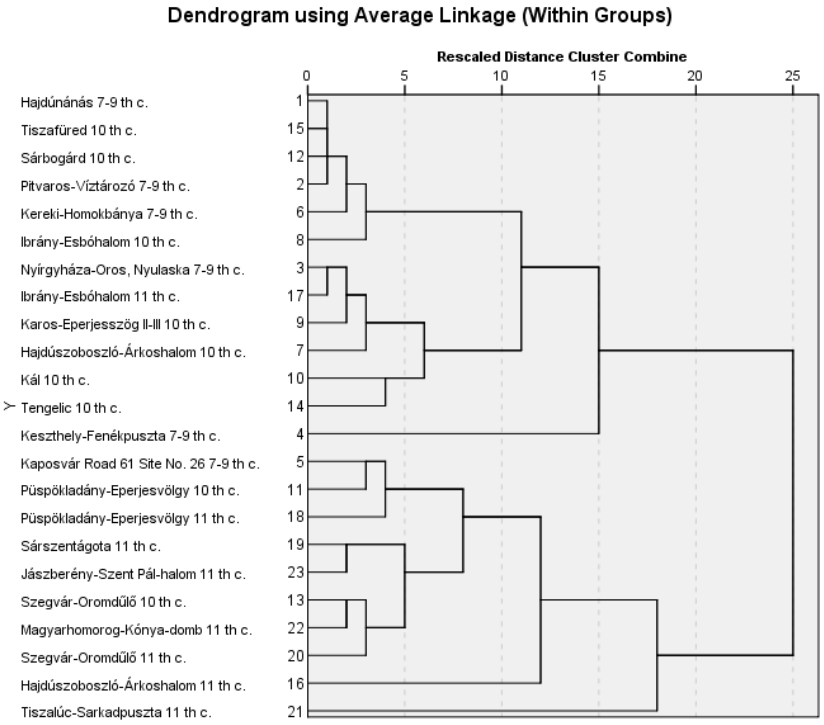

Fig. 1. The examined population's dendrogram by UPGMA (unweighted pair group method with arithmetic mean method) of life expectancy at birth of the cemeteries (c.: century).

deceased individuals within the population belonging to the aggregated category of 0–14 years. The average percentages of the combined d_{0-14} category suggested that the 7–10th century cluster (24.96%) has a lower proportion of child burials compared to the 11–13th century cluster (36.2%). This difference was also supported by a two-sample t-test (t-test, p=0.035, Figure 2), confirming that the proportion of child burials is significantly lower in the examined populations from the 7–10th century compared to the 11–13th century.

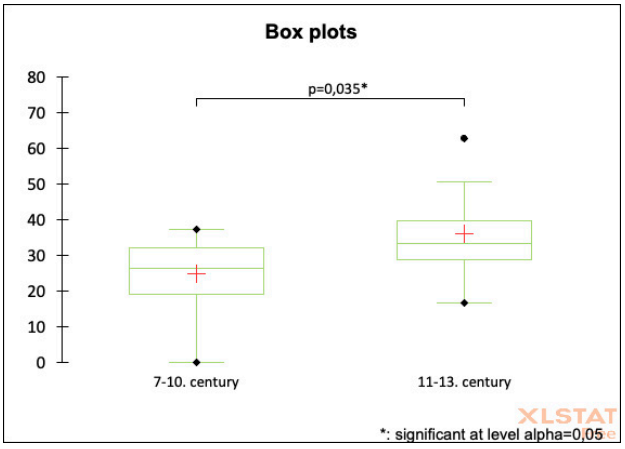

Fig. 2. Post-pair t-test Box plots of the pooled d0-14 percentages for the 7-10th century and 11-13th century populations of interest.

Conclusions

This study presents a comprehensive analysis conducted through hierarchical clustering, taking the mathematical and statistical limitations of the method into account. It successfully confirms the previously described tendency that the life expectancy at birth differs between the populations of the 7–10th and 11–13th centuries. When examining the mortality data of the studied populations more closely, this difference can be attributed to the altering proportions of child burials in the cemeteries. Based on the data from 23 representative populations from the Avar, Hungarian conquest, and Árpádian periods, it can be stated that there is a significant difference in the d_{0-14} percentages between the two periods, clearly indicating the different proportions of child burials. However, the results draw attention to the significant influence of local factors on the populations' life expectancy at birth. Similarities or differences in lifestyle, diseases or varying levels of interpersonal violence may be contributing factors.

The significant difference observed between the subadults from the 7–10th century populations and those from the 11–13th century populations is presumably related to the major social changes occurring in Hungary during this period. With the adoption of Christianity in the 11th

century, accompanied by changes in values and burial customs, there was a greater presence of child burials in the cemeteries from the 11th century. However, remnants of the pagan past may explain why newborns were not buried or were buried elsewhere. Similar customs can be observed among Palóc people or Southern Slav peoples, who often buried infants under the threshold. Another theory suggests that children were not as deeply buried as adults, which led to a higher rate of loss in the archaeological record during that period. However, it is assumed that the impact of this factor is not so important as to cause such pronounced differences in life expectancy at birth data.

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J. Turtóczki

Magyar Gyula Horticultural Technical School and Vocational Training School, Maglódi út 8, Budapest 1106, Hungary
e-mail: turtoczki.jozsef@gmail.com

OČEKIVANI ŽIVOTNI VIJEK OD AVARSKOG RAZDOBLJA DO ÁRPÁDSKOG DOBA: POGANSKO-KRŠĆANSKA PROMJENA U MAĐARSKOJ

S A Ž E T A K

Ovaj rad analizira podatke o očekivanom životnom vijeku pri rođenju sa značajnih arheoloških nalazišta u Mađarskoj vezanih za avarsko, mađarsko osvajanje i arpadsko razdoblje. Klaster analiza temeljena na podacima o očekivanom životnom vijeku pri rođenju uspješno razlikuje populacije iz razdoblja avarskog i mađarskog osvajanja od arpadske populacije. Vjerojatno je da lokalni čimbenici igraju značajnu ulogu u promatranom očekivanom trajanju života pri rođenju. Analiza pokazuje obrasce razvoja stanovništva slične onima opisanim u prethodnim istraživanjima. U skladu s njima, Püspökladány predstavlja primjer kontinuiranog rasta stanovništva, dok Ibrány pokazuje prekinuti razvoj. Klaster analiza također otkriva udaljeniji odnos između dva razdoblja nalazišta Ibrány u usporedbi s Püspökladányjem. Podaci o smrtnosti djece u dobi od 0-14 godina značajno se razlikuju između dva različita klastera u analizi, podupirući ideju da se razlika u očekivanom životnom vijeku pri rođenju može pripisati različitim udjelima ukopa djece. Pretpostavlja se da je prihvaćanje kršćanstva dovelo do promjena u pokopnim običajima, što je rezultiralo većim udjelom ukopa djece na grobljima od 11 st. nadalje.